CLAIMS

1. A distance detection apparatus comprising:

a wireless transmission system circuit that radio transmits a transmission signal after performing signal processing of the transmission signal for signal transmission;

a wireless reception system circuit that performs signal processing of a reception signal, which was received from an object of distance measurement, for signal reception; and

a distance detection section that measures a signal delay time in said wireless transmission system circuit and said wireless reception system circuit, and corrects a distance measurement value that is obtained by measuring a distance to the object, by using the signal delay time.

2. The distance detection apparatus according to claim 1, wherein

a time difference between transmission timing by said wireless transmission system circuit and reception timing by said wireless reception system circuit in a case where the transmission signal output from said wireless transmission system circuit is directly input into said wireless reception system circuit is measured, and the measured time difference is set as the signal delay time.

3. The distance detection apparatus according to claim 1, further comprising:

a first reference timer that generates first reference

timing; and

a signal generation section that generates a periodic signal synchronized with the first reference timing to input the periodic signal to said wireless transmission system circuit as the transmission signal; wherein

said distance detection section detects a first phase difference indicating a degree of a discrepancy of reception timing of the reception signal received from the object from the first reference timing, and detects the distance to the object by using the first phase difference, the detected signal delay time、a second phase difference and a signal delay time both being detected at the object.

4. The distance detection apparatus according to claim 3, wherein

the object is a communication station that has a second reference timer for generating second reference timing independently, and that measures the signal delay time at the object, and that detects a second phase difference indicating a degree of a discrepancy of the reception timing of the reception signal from the second reference timing, and that generates a periodic signal synthesized with the second reference timing in response to the reception of the transmission signal to transmit the generated periodic signal.

5. The distance detection apparatus according to claim 3, wherein

said distance detection section corrects the first

phase difference by using the detected signal delay time to obtain a corrected phase difference, and detects the distance to the object by using the corrected phase difference and an informed corrected phase difference informed by the object.

6. The distance detection apparatus according to claim 5, wherein

the objects a communication station that has a second reference timer for generating second reference timing independently, and that measures the signal delay time at the object, and that detects a second phase difference indicating a degree of a discrepancy of the reception timing of the reception signal from the second reference timing, and that corrects the second phase difference by using the signal delay time at the object, and that transmits the corrected phase difference as the informed corrected phase difference.

7. The distance detection apparatus according to claim 3, wherein

said distance detection section transmits the first phase difference and the detected signal delay time, or a corrected phase difference of the first phase difference corrected by the detected signal delay time to the object, and receives the second phase difference and the signal delay time , or a corrected phase difference of the second phase difference corrected by the signal delay time from the object.

8. The distance detection apparatus according to claim 5, wherein

said distance detection section obtains the corrected phase difference in conformity with the according formula,

(corrected phase difference) = (first phase difference) - (detected signal delay time).

9. The distance detection apparatus according to claim 8, wherein

said distance detection section detects the distance to the object in conformity with the following formula,

(distance) = K × ((corrected phase difference) + (informed corrected phase difference)) / 2

where K is a constant corresponding to the light velocity.

10. The distance detection apparatus according to claim 6, wherein

said distance detection section determines a correction quantity for an adjustment of the first reference timer and the second reference timer by a use of the corrected phase difference and the informed corrected phase difference.

11. The distance detection apparatus according to claim 10, wherein

said distance detection section determined a correction quantity of the second reference timer on a basis of the first reference timer in conformity with the following formula,

(correction quantity of second reference timer) =

((corrected phase difference) - (informed corrected phase difference)) / 2.

12. The distance detection apparatus according to claim 10, wherein

said distance detection section determines a correction quantity of the first reference timer on a basis of the second reference timer in conformity with the following formula,

(correction quantity of first reference timer) = ((informed corrected phase difference) - (corrected phase difference)) / 2.

13. The distance detection apparatus according to claim 10, wherein

said distance detection section detects the distance to the object in conformity with the following formula after said distance detection section performed the adjustment of the first reference timer and the second reference timer on a basis of the correction quantity for the adjustment,

(distance) = K × (corrected phase difference)

where K is a constant corresponding to the light velocity.

14. The distance detection apparatus according to claim 10, wherein

said distance detection section detects the distance to the object in conformity with the following formula after said distance detection section determined the correction quantity of the second reference timer,

(distance) = K × ((corrected phase difference) -

(correction quantity of second reference timer))

where K is a constant corresponding to the light velocity.

15. The distance detection apparatus according to claim 1, further comprising:

a first reference timer that generates first reference timing; and

a signal generation section that generates a periodic signal synchronized with the first reference timing to input the periodic signal to said wireless transmission system circuit as the transmission signal; wherein

said distance detection section detects a first phase difference indicating a degree of a discrepancy of reception timing of a reflection wave of the transmission signal reflected by the object from the first reference timing, and detects the distance to the object in conformity with the following formula,

(distance) = K × ((first phase difference) − (detected signal delay time)) / 2

where k is a constant corresponding to the light velocity.

16. The distance detection apparatus according to claim 1, wherein

the transmission signal is a spectrum spreading signal.

17. The distance detection apparatus according to claim 1, wherein

said apparatus performs wireless communication between the object in conformity with a spectrum spreading

communication mode.

18. A method for detecting a distance to an object of distance measurement, said method comprising:

detecting respective signal delay times of a wireless transmission system circuit for executing signal processing of a transmission signal for transmitting and a wireless reception system circuit for executing signal processing of a reception signal for receiving;

transmitting the transmission signal to the object through the wireless transmission system circuit;

receiving a signal transmitted in response to reception of the transmission signal from the object; and

calculating a distance to the object by using phase information of the reception signal and the detected signal delay time.

19. A method for detecting a distance to an object of distance measurement, said method comprising:

detecting respective signal delay times of a wireless transmission system circuit for executing signal processing of a transmission signal for transmitting and a wireless reception system circuit for executing signal processing of a reception signal for receiving;

transmitting the transmission signal to the object through the wireless transmission system circuit;

receiving a reflected wave of the transmission signal from the object ; and

calculating a distance to the object by using phase

information of the reception signal and the detected signal delay time.

20. A distance detection apparatus comprising:

a wireless transmission system circuit that transmits a transmission signal after performing signal processing of the transmission signal for signal transmission;

a wireless reception system circuit that performs signal processing to a reception signal, which was received from an object of distance measurement, for signal reception;

a recording medium storing a distance detection program; and

a processor operating in conformity with the distance detection program, wherein

the distance detection program makes said processor measure signal delay times in the wireless transmission system circuit and in the wireless reception system circuit, and makes said processor transmit the transmission signal to the object through the wireless transmission system circuit, and further makes said processor calculate a distance to the object by using phase information of the reception signal and the detected signal delay time when the wireless reception system circuit received the reception signal from the object.

21. A distance detection apparatus comprising:

a wireless transmission system circuit that transmits a transmission signal after performing signal processing

of the transmission signal for signal transmission;

a wireless reception system circuit that performs signal processing of a reception signal, which was received from an object of distance measurement, for signal reception;

a recording medium storing a distance detection program; and

a processor operating in conformity with the distance detection program, wherein

the distance detection program makes said processor measure signal delay times in the wireless transmission system circuit and in the wireless reception system circuit, and makes said processor transmit the transmission signal to the object through the wireless transmission system circuit, and further makes said processor calculate a distance to the object by using phase information of the reception signal and the detected signal delay time when the wireless reception system circuit received a reflected wave of the transmission signal from the object .

22. The distance detection apparatus according to claim 20, wherein

the recording medium is any one of a semiconductor memory, a magnetic recording medium, an optical recording medium, and an optical magnetic recording medium.